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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,305	11/14/2003	Jei-Wei Chang	HTIRC03-005	2109

7590 10/10/2006

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EXAMINER	
CHACKO DAVIS, DABORAH	
ART UNIT	**PAPER NUMBER**
1756	

DATE MAILED: 10/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/714,305	CHANG ET AL.	
	Examiner	Art Unit	
	Daborah Chacko-Davis	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 July 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-9 and 32-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9,32-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-2, 4-8, 32, 34-35, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,904,619 (Yamada et al., hereinafter referred to as Yamada) in view of U. S. Patent No. 6,833,234 (Bloomstein et al., hereinafter referred to as Bloomstein).

Yamada, in col 3, lines 29-64, in col 4, lines 63-68, in col 5, lines 1-13, and figure 1(a) through figure 1(d), discloses a liftoff method comprising a photoresist layer on the substrate, exposing and developing the resist layer to form a resist pattern having sidewalls and an upper surface (see reference 15), performing and ion beam irradiation so as to cause hardening of the resist surface on the top portion (upper surface hardened) of the resist pattern that is resistant to chemical attack, such that the bottom portion (shadowed region) of the resist pattern remains unhardened, exposing the resist pattern to oxidation using plasma ashing resulting in the under cut of the photoresist pattern (unhardened bottom portion of the resist pattern eroded), wherein the top portion of the resist pattern overhangs the bottom shrunk portion, forming a layer (depositing) of thin film over the resist pattern at a thickness less than that of the bottom under cut portion (unhardened photoresist layer), removing the shrunk bottom portion of

the photoresist resulting in a lift-off of the material that is deposited on the resist pattern (claims 1, 32,). Yamada, in col 4, lines 36-37, discloses that the resist is a positive resist (claim 2). Yamada, in col 5, lines 1-5, discloses that the ion beam has the claimed voltage (claim 4). Yamada, in col 5, lines 1-16, discloses that the ion beam is impinged on the resist pattern for about 3 minutes, and the top hardened layer of the resist pattern extends to about 50nm (claims 5-6, 34). Yamada, in col 5, lines 10-12, discloses that the hardened layer (unetched overhang) overhangs the shrunk bottom resist by about 0.2nm (claims 8, 35). Yamada, in col 5, lines 60-63, discloses that the unhardened photoresist layer (resist pattern with the undercut portion) is removed by treating the resist with the developer.

The difference between the claims and Yamada is that Yamada does not disclose exposing the resist pattern to ozone. Yamada does not disclose the ozone exposure process recited in claim 7.

Bloomstein, in col 11, lines 60-67, in col 12, lines 1-7, discloses performing an ozone exposure process after exposing the resist. Bloomstein, in col 12, lines 1-7, in col 24, lines 25-52, and in figure 6B, discloses using the ozone concentration, and flow rate as recited for performing the ozone exposure for at least one minute at a temperature of about 100°C (after PAB at 100°C).

Therefore it would be obvious to a skilled artisan to modify Yamada by replacing the oxygen plasma ashing with an ozone oxidation step as suggested by Bloomstein because Bloomstein, in col 14, lines 1-7, discloses that the resist surface treatment can be performed by either ozone treatment or oxygen plasma treatment, and

Bloomstein, in col 19, lines 30-40, discloses that treatment with ozone as claimed increases the hydrophilicity of the surface of the resist, and increases the surface energy of the polymers inorder to promote adhesion.

3. Claims 3, and 33, are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,904,619 (Yamada et al., hereinafter referred to as Yamada) in view of U. S. Patent No. 6,833,234 (Bloomstein et al., hereinafter referred to as Bloomstein) as applied to claims 1-2, 4-8, 32, 34-35 above, and further in view of U. S. Patent no. 6,383,944 (Furihata et al., hereinafter referred to as Furihata).

Yamada in view of Bloomstein is discussed in paragraph no. 3.

The difference between the claims and Yamada in view of Bloomstein is that Yamada in view of Bloomstein does not disclose that the photoresist layer thickness is between about 0.1 and 0.4 microns (claims 3, and 33).

Furihata, in col 2, lines 28-36, discloses that the resist layer thickness in the lift-off resist pattern is about 0.5μ.

Therefore it would be obvious to a skilled artisan to modify Yamada in view of Bloomstein by employing the resist thickness suggested by Furihata because Furihata, in col 2, lines 40-49, discloses that if the thickness range is beyond the range suggested the lift-off resist pattern would be less smooth to lift off.

4. Claim 9, is rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 4,904,619 (Yamada et al., hereinafter referred to as Yamada) in view of U. S. Patent No. 6,833,234 (Bloomstein et al., hereinafter referred to as Bloomstein) as

applied to claims 1-2, 4-8, 32, 34-35 above, and further in view of U. S. Patent No. 5,512,334 (Leuschner et al., hereinafter referred to as Leuschner).

Yamada in view of Bloomstein is discussed in paragraph no. 3.

Bloomstein, in col 23, lines 38-65, in col 24, lines 25-45, discloses that the resist is developed at the claimed temperature range, and developing time.

The difference between the claims and Yamada in view of Bloomstein is that Yamada in view of Bloomstein does not disclose using an NMP as the developer.

Leuschner, in col 2, lines 31-34, and in col 3, lines 20-25, discloses that the lift-off resist is heated and developed by means of N-methyl pyrrolidone (NMP).

Therefore, it would be obvious to a skilled artisan to modify Yamada in view of Bloomstein by employing the developer and developing process suggested by Leuschner because Leuschner, in col 2, lines 30-31, discloses that heating the resist enables the removal of the resist with the claimed developer, and Leuschner in col 3, lines 20-24, discloses the bottom portion of the resist together with the top hardened portion of the resist can be dissolved with a non-toxic organic solvent such as NMP.

Response to Arguments

5. Applicant's arguments filed July 17, 2006, have been fully considered but they are not persuasive. The 103 rejections made in the previous office action (paper no. 0515) are maintained.

A) Applicants argue that Yamada does not teach exposing the photoresist layer to an ion beam such that the energy of the ion beam is too low to sputter the photoresist layer.

Yamada, in col 5, lines 1-10, discloses irradiating with a sputter ion beam at the claimed energy level to harden the surface of the photoresist. Yamada does not teach sputtering the photoresist layer.

B) Applicants argue that Yamada does not teach an ion beam of the claimed voltage.

Yamada, in col 5, lines 1-3, discloses that the photoresist surface is subjected to a sputter ion beam exposure with an RF power of about 20W. An RF power of 20 watts in a sputter ion beam system corresponds to an ion beam of voltage of about 200 volts (claimed range).

C) Applicants argue that Bloomstein does not teach a change in dimension in the resist exposed to ozone.

Bloomstein is not depended upon to show a change in dimension in the photoresist. Bloomstein is depended upon to show the interchangeability of photoresist exposure to either an ozone treatment or an oxygen plasma treatment.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Daborah Chacko-Davis whose telephone number is (571) 272-1380. The examiner can normally be reached on M-F 9:30 - 6:00. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on (571) 272-1385. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

dcd

September 29, 2006.

JOHN A. MCPHERSON
PRIMARY EXAMINER